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Major article

# National prevalence of methicillin-resistant *Staphylococcus aureus* in inpatients at United States health care facilities, 2010

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***Background:*** Methicillin-resistant *Staphylococcus aureus* (MRSA) remains one of the most prevalent multidrug-resistant organisms causing health care-associated infections. Limited data are available about how the prevalence of MRSA has changed over the past several years and what MRSA prevention practices have been implemented since the 2006 Association for Professionals in Infection Control and Epidemiology, Inc, MRSA survey.

***Methods:*** We conducted a national prevalence survey of MRSA colonization or infection in inpatients at US health care facilities. The survey was developed, received institutional review board approval, and then was distributed to all US Association for Professionals in Infection Control and Epidemiology, Inc, members. Members were asked to complete the survey on 1 day during the period August 1 to December 30, 2010, reporting the number of inpatients with MRSA infection or colonization and facility- and patient-specific information.

***Results:*** Personnel at 590 facilities indicated a state and responded to the survey. All states were represented, except for Alaska and Washington, DC (mean, 12 facilities per state; range, 1-38). Respondents reported 4,476 MRSA-colonized/infected patients in 67,412 inpatients; the overall MRSA prevalence rate was 66.4 per 1,000 inpatients (25.3 infections and 41.1 colonizations per 1,000 inpatients). Active surveillance testing was conducted by 75.7% of the respondents; 39.6% used nonselective media, 37.2% used selective media, and 23.3% used polymerase chain reaction. Detailed data were provided on 3,176 MRSA-colonized/infected patients. Of those in whom colonization/infection status was reported (1,908/3,086 [61.8%] were MRSA colonized and 1,778/3,086 [38.2%] were MRSA infected), most MRSA-colonized or infected patients (78.3%) were detected within 48 hours of admission; the most common site of infection was skin and soft tissue (42.9%); and, using the Centers for Disease Control and Prevention's definitions, approximately 50% would be classified as health care-associated infections.

***Conclusion:*** Our survey documents that the MRSA prevalence in 2010 is higher than that reported in our 2006 survey. However, the majority of facilities currently are performing active surveillance testing, and, compared with 2006, the rate of MRSA infection has decreased while the rate of MRSA colonization has increased. In addition, compared with 2006, the proportion of MRSA strains recovered from MRSA-colonized/infected patients that are health care-associated strains has deceased, and community-associated strains have increased.



In 2006, the Association for Professionals in Infection Control and Epidemiology, Inc (APIC) conducted the first national methicillin-resistant *Staphylococcus aureus* (MRSA) prevalence study in the United States.[1] Since that time, a variety of studies has been published on the following: (1) the economic and patient impact of MRSA infections,[2-8] (2) the further emergence of community-associated MRSA,[9-12] (3) legislation passed in some states for mandatory screening and/or reporting of MRSA infections[13,14] (http://www.apic.org/downloads/legislation/MRSA_map.gif), (4) conflicting reports of prevention/control or lack thereof of MRSA colonization or infection with active detection and isolation (ADI) or other methods,[15-22] (5) a decrease in MRSA central line-associated bloodstream infections at Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network intensive care units (ICUs),[23] (6) 2 CDC

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population-based studies indicating a decrease in invasive or health care-associated MRSA infections in 9 metropolitan areas,[24,25] (7) the development of and challenges applying the Society for Healthcare Epidemiology of America/Healthcare Infection Control Practices CDC metrics for multidrug-resistant organisms,[26-28] (8) the Department of Health and Human Services has included MRSA reduction goals in their Action Plan (http://www.hhs.gov/ash/initiatives/hai/appendices.html#appendix_g), (9) the CDC has reported a decrease in invasive and health care-associated infection MRSA rates (http://www.cdc.gov/mrsa/statistics/index.html), and (10) there has been continued debate on the value of focusing infection prevention methods on MRSA.[15,17,20,29-32] As a result, we thought it would be valuable to repeat the APIC National MRSA prevalence survey to determine (1) what has happened to the prevalence of MRSA in US health care facilities and (2) what changes in MRSA prevention and control practices had taken place since 2006 at US health care facilities.

## METHODS

Our survey was developed and approved by the APIC Science and Knowledge Implementation Network and the APIC Board of Directors, β tested by APIC members at several hospitals, and then approved by the Institutional Review Board (Sharp Memorial Hospital, San Diego, CA). To reach all US APIC members, the APIC announced the survey in April 2010 and continued to encourage participation through various e-mail and/or print communications through December 2010. Simultaneously, the APIC also added a project-specific page to its Web site to facilitate member engagement in the study.

The electronic survey was placed on the APIC secure Web site and was available in hard copy for those without Internet access. All US APIC members were invited to participate and to encourage non-APIC infection preventionists (IPs) to do so. Each IP determined whether additional institutional review board approval was needed at his/her own facility. IPs were asked to identify 1 day between June 1 and December 30, 2010, on which to conduct the MRSA prevalence survey. On the day selected, participants were asked to identify all inpatients known to be colonized or infected with MRSA. No patient testing or interviews were requested or required.

The survey questionnaire had 2 parts. Part 1 included facility data such as location (state), type (public, private; adult, children's, women's; acute, long-term care), number of licensed beds, number of inpatients on the survey date, types of intensive care units (ICUs), specialty services, health care-associated infection (HAI) surveillance performed (site and patient population), and MRSA HAI surveillance definitions used. In addition, data were collected on the number of known MRSA inpatients on the survey date; what isolation measures were implemented for MRSA-positive patients; whether active surveillance testing (AST) is done routinely to detect MRSA-colonized patients, and, if yes, what sites and populations are tested, what microbiologic methods are used; what CDC metrics are used to determine MRSA rates[33]; and what method is used to differentiate health care-associated (HA) from community-associated (CA) MRSA[24] (http://www.cdc.gov/nhsn/PDFs/pscManual/12pscMDRO_CDADcurrent.pdf). In addition, IPs were asked what preoperative skin antiseptic they routinely used on surgical patients and whether they performed preoperative MRSA screening, nasal mupirocin decolonization, or chlorhexidine preoperative bathing.

Part 2 of the survey included detailed data on each patient identified as MRSA colonized or infected, including age, gender, service, duration from admission to MRSA-positive test (≥48 hours or ≥3 days); whether the patient was located in the ICU; whether the patient was identified by clinical culture, AST, or both (and the type of test method used); colonization or infection status (and if infected, the site); underlying conditions; and colonizing/infecting MRSA strain antimicrobial susceptibility to 6 antimicrobials (ie, levofloxacin, clindamycin, erythromycin, tetracycline, gentamicin, and trimethoprim-sulfamethoxazole).

If the respondent had Internet access, all survey responses were entered directly by hospital person onto the data collection form on the APIC secure Web site. If respondents did not have Internet access, they completed a paper copy of the survey that then was faxed to APIC headquarters, where the data were entered into the database.

The database was converted to an Excel file (Excel; Microsoft Corp, Redmond, WA) database and analyzed using SPSS (SPSS Gradpack 17.0; SPSS Inc, Chicago, IL). Respondents were defined as those indicating a state for their facility and responding to the questionnaire. For analysis, we included as the denominator for each question the number of facilities answering that specific question. For calculation of the MRSA rate, we required that the facility responded to *both* the numerator (number of MRSA patients [question 14]) and the denominator (number of inpatients [question 4E]) questions; all facilities in which either the numerator or denominator question was blank were excluded as were any facilities that had a zero as the denominator.

## RESULTS

There were 590 health care facility respondents. Because we were unable to determine the number of APIC-member health care facilities that received the survey (because only 1 response from each facility regardless of the number of APIC members at that facility were accepted), a response rate could not be calculated. Respondents represented facilities from all US states, except Alaska and Washington, DC, with an average of 12 respondents per state (range, 1-39) (Fig 1). Respondent hospitals were more likely to be urban (328/586; 56%), public (323/571; 56.7%), acute care facilities (366/402; 91%), not tertiary care facilities (279/398; 71%), or not medical school affiliated (282/408; 68.9%); most were either between 100 and <500 beds (310; 48.9%) or <100 beds (257; 40.5%). Respondent health care facilities had an average of 1.67 (range, 0-12.5) IPs. Approximately half (310; 45.8%) of the respondents reported that they participated in the 2006 APIC MRSA survey.

The health care facility respondents (n = 402) reported 4,476 MRSA-colonized or -infected patients in 67,412 inpatients, giving an overall MRSA prevalence of 66.4 per 1,000 inpatients. Based on the detailed patient data, there were 2,767 MRSA-colonized patients giving an MRSA-colonization prevalence of 41.1 per 1,000 inpatients and 1,709 MRSA-infected patients, giving an MRSA-infection prevalence rate of 25.3 per 1,000 inpatients. The MRSA prevalence rate ranged from a low of 0 in South Dakota to 110.8 per 1,000 inpatients in Texas (Fig 2). When asked how their facilities MRSA rate had changed since 2006, 250 of 454 (55.1%) reported that it had decreased, 105 of 454 (23.1%) reported it had increased, and 99 of 454 (21.8%) reported it was unchanged. When asked if they were doing everything they would like to prevent and control MRSA transmission, 144 of 419 (65.6%) answered "no." Of those answering "no," barriers reported included the following: inadequate personnel resources (57.8%), inadequate financial resources (52.7%), inadequate administrative support (30.9%), inadequate isolation facilities (26.9%), inadequate laboratory support (19.6%), or other reasons (29.5%).

Detailed data were provided on 3,176 MRSA-colonized or -infected inpatients. Their mean age was 60.5 years (range, <1 month - 104 years), 1,654 of 3,176 (52.2%) were male, 1,492 of 2,880 (51.8%) were detected by clinical culture, 1,388 of 2,880 (48.2%) were detected by AST, 2,552 of 3,069 (83.2%) were on medical services, and 718 of 2,939 (24.4%) were in ICUs. Nearly three-quarters (n = 2,437/3,176; 76.7%) of the MRSA-colonized/infected patients reported had 1 or more underlying conditions; these included 32.1% (n = 783) with diabetes mellitus, 21.1% (n = 514) with chronic lung disease, 18.0% (n = 439) with chronic heart disease, and 12.2% (n = 298) had other underlying